

ANNEXES

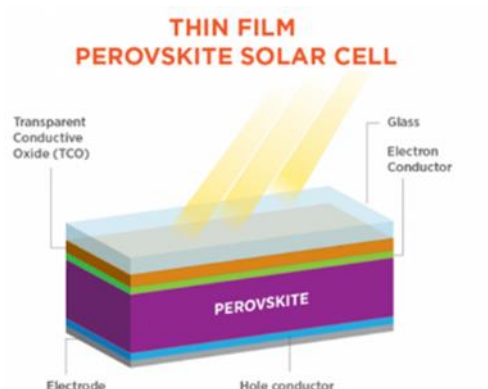


Figure A1.: Thin-film n-i-p perovskite solar cell (PSCs)¹⁶

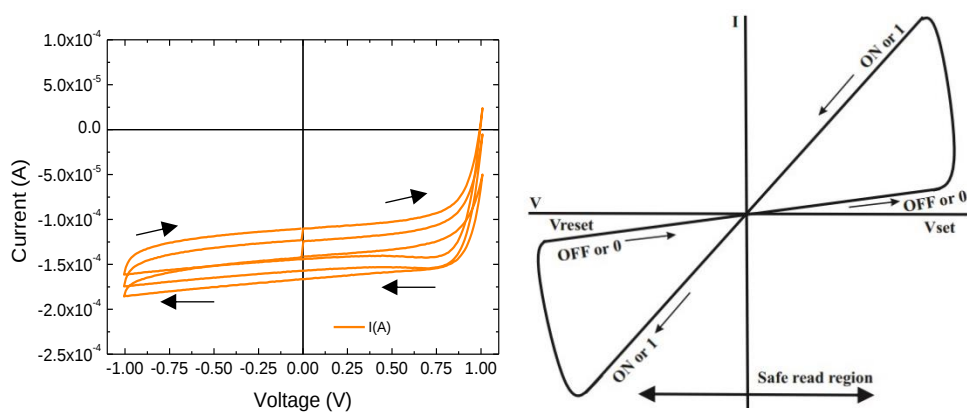


Figure A2.: Left) Bottle-shaped curve, Right) Crossed loop curve.



Figure A3.: WS-400BZ-&NPP/LITE spin-coater device.



Figure A4.: UV Ozone Cleaner™ by Bioforce Nanosciences

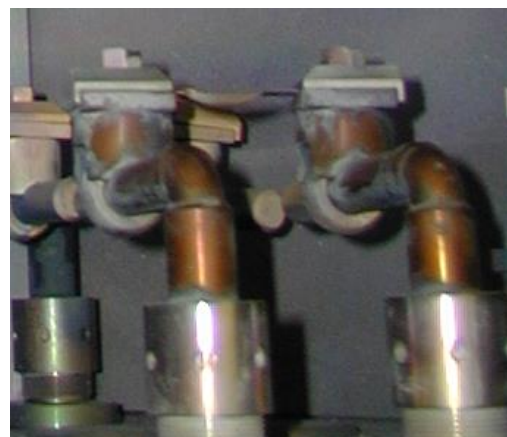
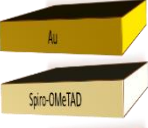
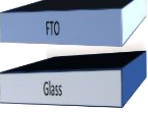


Figure A5.: Left) Thermal evaporator used for gold electrode deposition. Right) Thermal evaporator metallic boat which generates evaporated gold.



Figure A6.: Autolab PGSTAT101

Table A1: PV and memristor parameters of sample 1-4 .

Structure		Solar Cell						Memristor			
	NR.	Scan direction	PCE (%)	J_{sc} (mA/cm ²)	V_{oc} (V)	FF (%)	HI	ON/OFF ratio	V_{set}	V_{reset}	Endurance time (40 cycles)
	1	REV	8.3	14.04	1.01	59	0.63	2.59	-0.63	-0.30	NO
		FWD	3.1	12.91	0.84	32					
	2	REV	6.9	13.08	0.98	54	0.54	3.49	-0.70	-0.27	NO
		FWD	3.2	11.43	0.91	31					
	3	REV	5.5	11.69	0.95	49	0.44	2.63	-0.70	-0.23	NO
		FWD	3.1	10.09	0.88	36					
	4	REV	4.1	9.76	0.90	47	0.56	3.80	-0.78	-0.25	NO
		FWD	1.8	6.87	0.71	36					

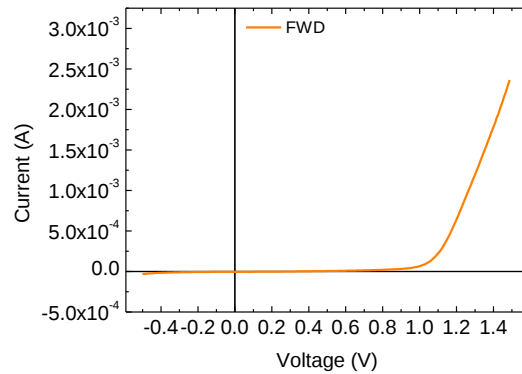
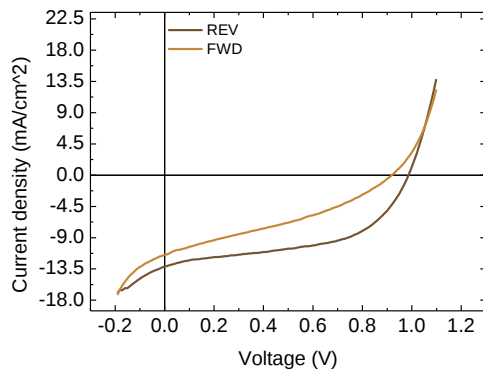


Figure A7.: Sample 2: Left) J-V curve under 1 sun illumination

Right) I-V curve dark conditions

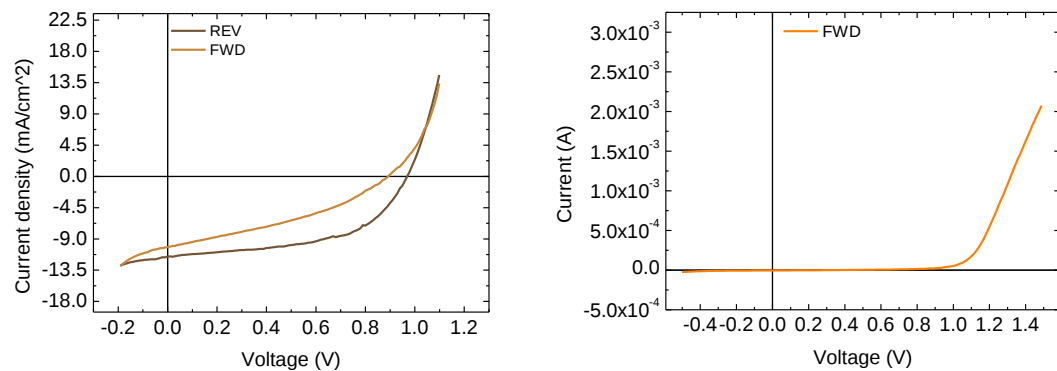


Figure A8.: Sample 3: Left) J-V curve under 1 sun illumination
Right) I-V curve dark conditions.

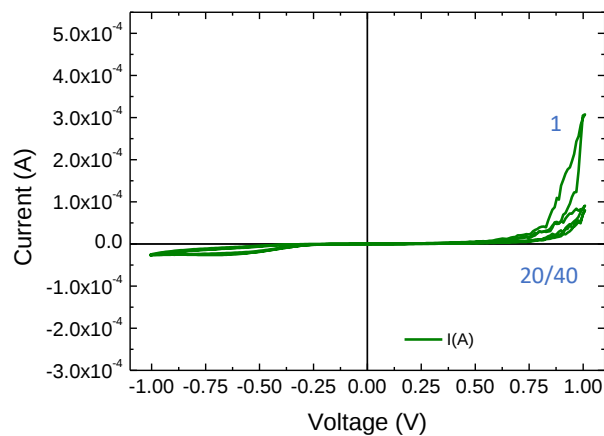


Figure A9.: Cyclic voltammetry of **sample 1** in dark conditions
(Only cycle 1st, 20th and 40th are represented.)

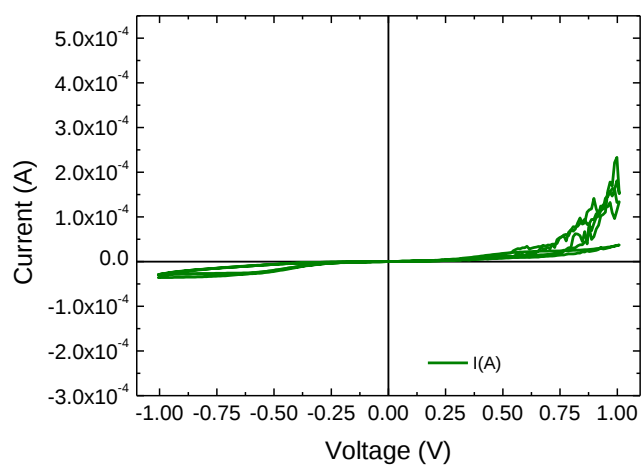


Figure A10.: Cyclic voltammetry of **sample 2** in dark conditions.
(Only cycle 1st, 20th and 40th are represented.)

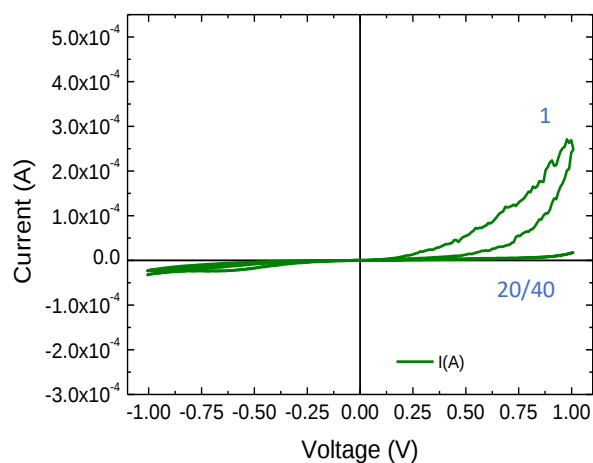


Figure A11.: Cyclic voltammetry of **sample 3** in dark conditions.
(Only cycle 1st, 20th and 40th are represented.)

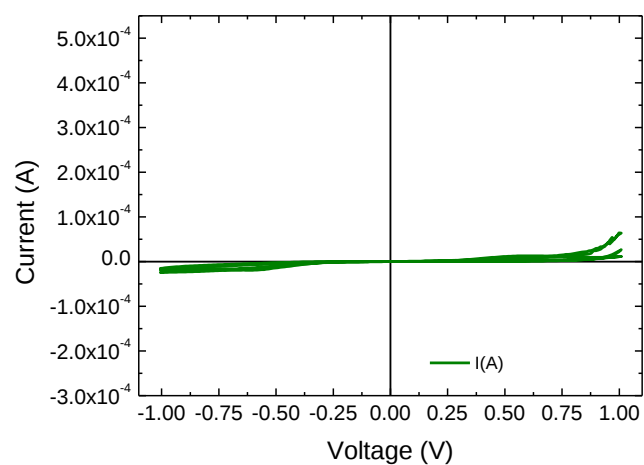


Figure A12.: Cyclic voltammetry of **sample 4** in dark conditions.
(Only cycle 1st, 20th and 40th are represented.)

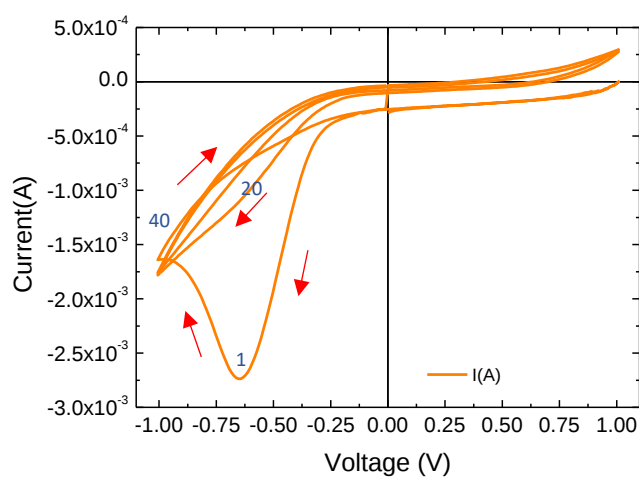


Figure A13.: Cyclic voltammetry of **sample 2** under 1 sun illumination.
(Only cycle 1st, 20th and 40th are represented.)

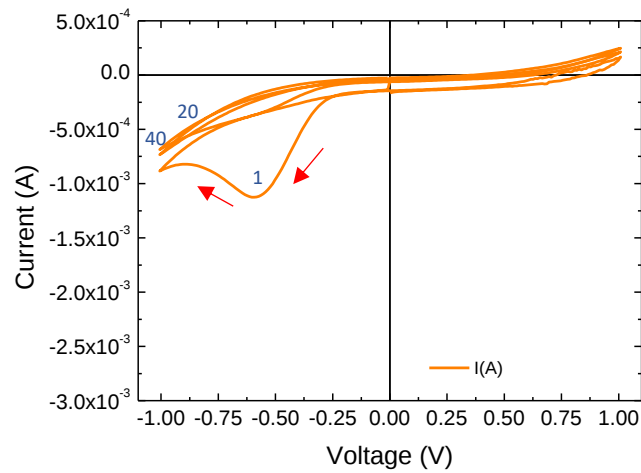
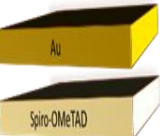
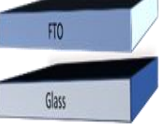


Figure A14.: Cyclic voltammetry of **sample 3** under 1 sun illumination.
(Only cycle 1st, 20th and 40th are represented.)

Table A2.: PV and memristor parameters of sample 5-8.

Structure		Solar Cell						Memristor			
	N R.	Scan direction	PCE (%)	J_{sc} (mA/cm ²)	V_{oc} (V)	FF (%)	HI	ON/OFF ratio	V_{set}	V_{reset}	Endurance time (40 cycles)
	5	RE V	9.4	15.13	0.95	66	0.43	1.15	-	-0.29	YES
		FW D	5.4	12.75	0.97	43			-	-0.80	
	6	RE V	7.3	11.73	0.97	64	0.51	1.34	-	-0.28	YES
		FW D	3.6	9.15	0.97	40			-	-0.84	
	7	RE V	2.5	9.58	0.70	37	0.64	-	-	-	-
		FW D	0.9	7.78	0.43	28			-	-	
	8	RE V	2.1	10.94	0.63	31	0.71	-	-	-	-
		FW D	0.6	8.66	0.28	26			-	-	

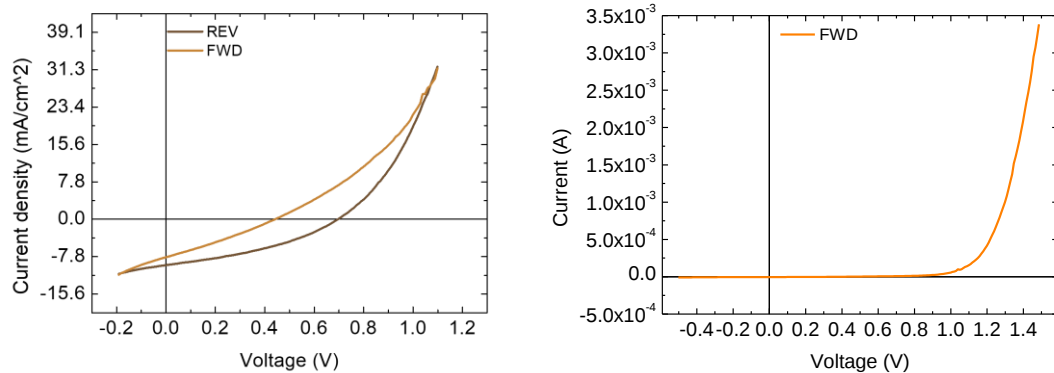


Figure A15.: Sample 7: Left) J-V curve under 1 sun illumination.
Right) I-V curve dark conditions

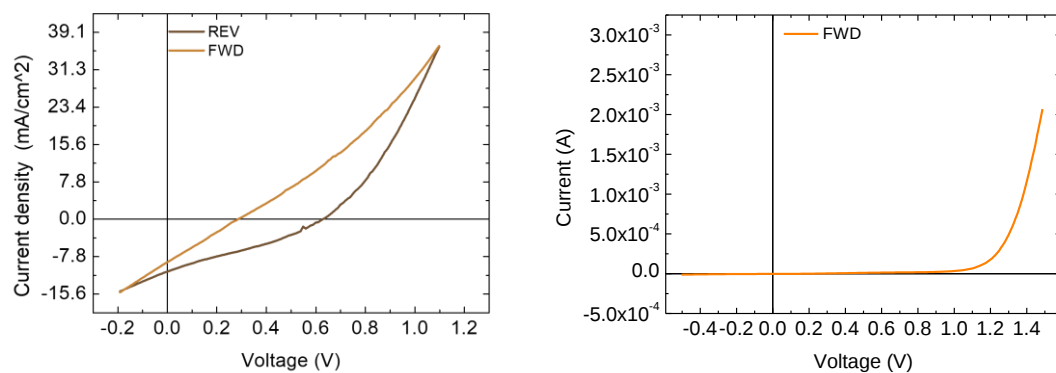


Figure A16.: Sample 8: Left) J-V curve under 1 sun illumination.
Right) I-V curve dark conditions

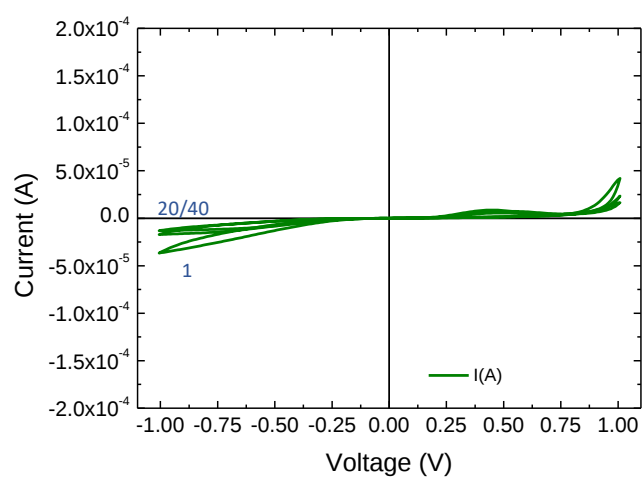


Figure A17.: Cyclic voltammetry of sample 6 in dark conditions.
(Only cycle 1st, 20th and 40th are represented.)

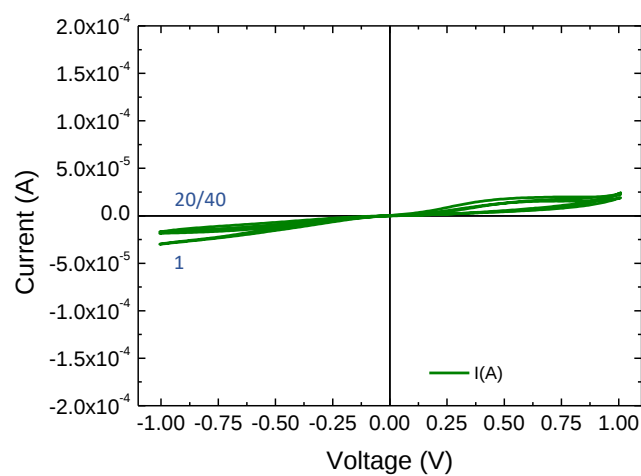


Figure A18.: Cyclic voltammetry of **sample 7** in dark conditions.

(Only cycle 1st, 20th and 40th are represented.)

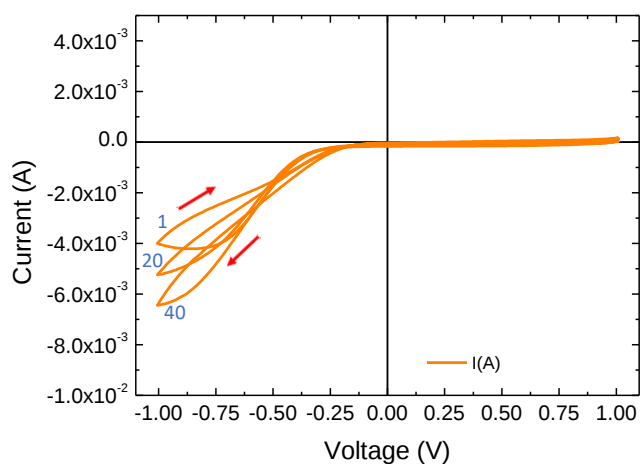


Figure A19.: Cyclic voltammetry of **sample 6** under 1 sun illumination.

(Only cycle 1st, 20th and 40th are represented.)

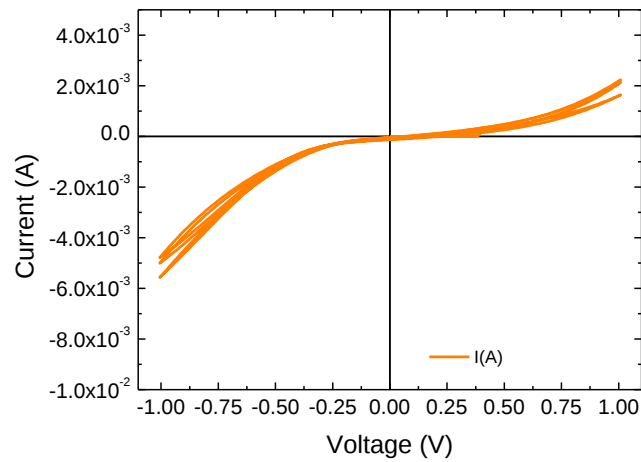


Figure A20.: Cyclic voltammetry of **sample 7** under 1 sun illumination.
(Only cycle 1st, 20th and 40th are represented.)

Table A3.: PV and memristor parameters of sampleS 9-12.

Structure		Solar Cell						Memristor			
	Sam ple NR.	Scan directio n	PCE (%)	J_{sc} (mA/cm ²)	V_{oc} (V)	FF (%)	Hysteresis index	ON /OFF ratio	V_{set}	V_{reset}	Endurance time (40 cycles)
	9	REV	8.9	-12.46	1.03	68	0.36	1.45	0.7 9	-	YES (Increase with cycles)
		FWD	5.7	-10.32	1.01	54					
	10	REV	7.3	-9.20	1.04	64	0.37	1.52	0.8 0	-	YES (Increase with cycles)
		FWD	4.6	-7.70	1.05	51					
	11	REV ³	5.4	-11.41	0.93	56	0.48	-	-	-	-
		FWD	2.8	-8.55	0.73	45					
	12	REV	5.2	-7.14	1.02	62	0.38	1.29	0.7 5	-	YES (Increase with cycles)
		RWD	4.5	-6.09	1.02	56					

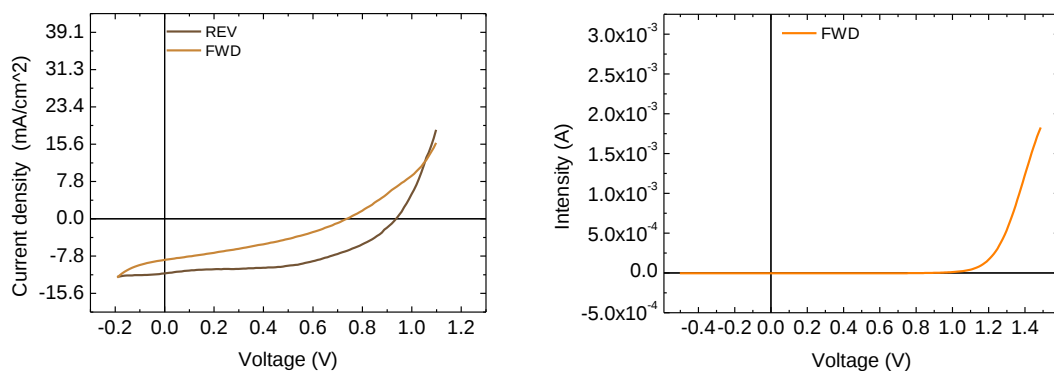


Figure A21.: Sample 11: Left) J-V curve under 1 sun illumination
Right) I-V curve dark conditions

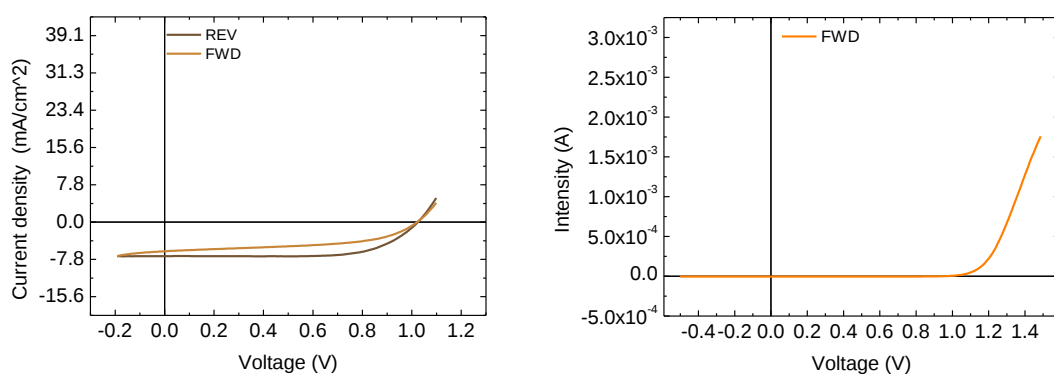


Figure A22.: Sample 12: Left) J-V curve under 1 sun illumination.
Right) I-V curve dark conditions

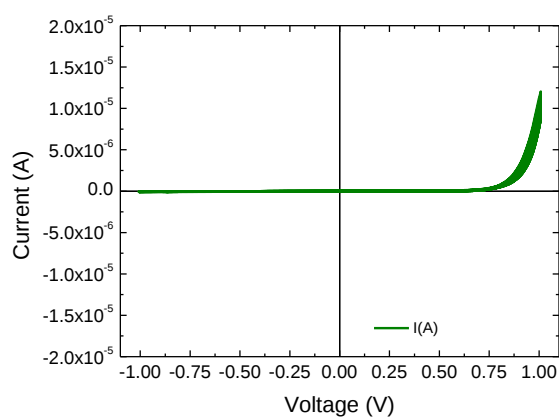


Figure A23.: Cyclic voltammetry of sample 11 in dark conditions.
(Only cycle 1st, 20th and 40th are represented.)

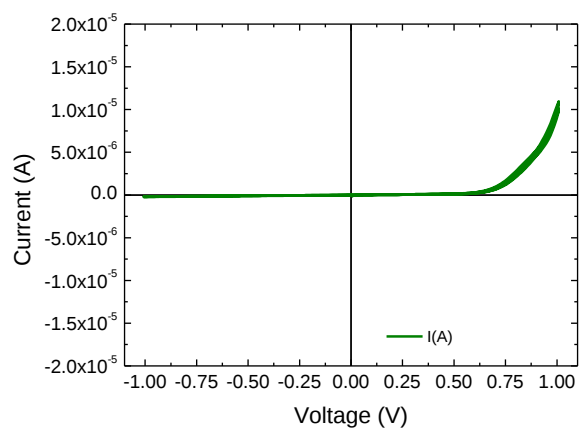


Figure A24.: Cyclic voltammetry of **sample 12** in dark conditions.
(Only cycle 1st, 20th and 40th are represented.)

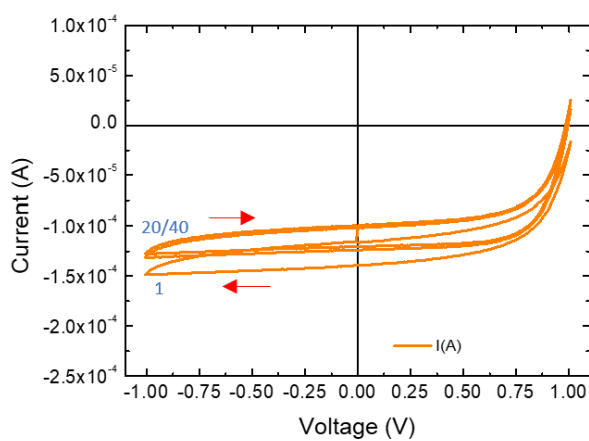


Figure A25.: Cyclic voltammetry of **sample 12** under 1 sun illumination.
(Only cycle 1st, 20th and 40th are represented.)

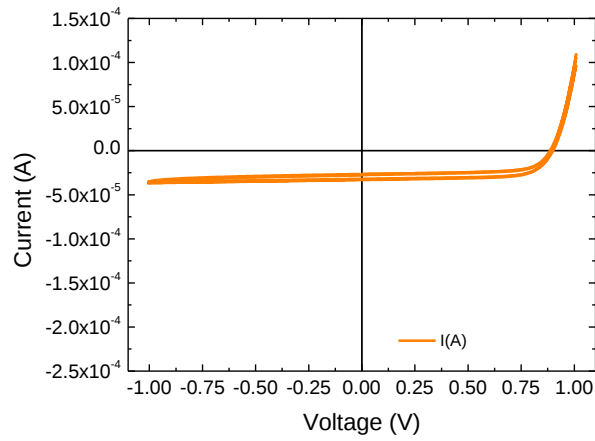


Figure A26.: Cyclic voltammetry of sample **11** under 1 sun illumination.

(Only cycle 1st, 20th and 40th are represented.)

Table A4.: PV and memristor parameters of sample 13-16.

Structure	NR	Solar Cell						Memristor			
		Scan direction	PC E (%)	J _{sc} (mA/cm ²)	V _{oc} (V)	FF (%)	HI	ON/OFF ratio	V _{set}	V _{reset}	Endurance time (40 cycles)
	13	REV	4.7	-7.49	0.98	64	0.49	3.07	0.68	-	YES
		FWD	2.4	-6.08	0.97	41					
	14	REV	4.3	-12.42	0.96	57	0.51	3.70	0.78	-	YES
		FWD	2.1	-10.82	0.9	31					
	15	REV	2.9	-5.01	0.99	63	0.24	1.48	0.71	-	YES
		FWD	2.2	-3.81	0.99	46					
	16	REV	2.5	-15.94	0.91	47	0.2	2.24	0.69	-	YES

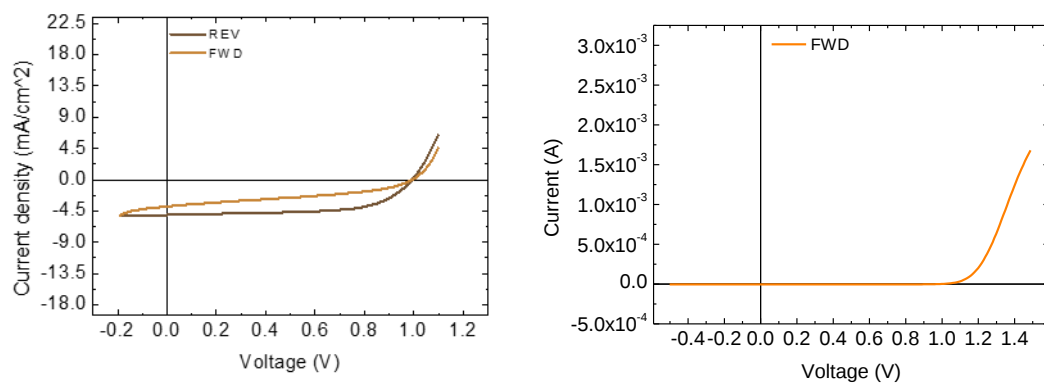


Figure A27.: Sample 15: Left) J-V curve under 1 sun illumination
Right) I-V curve dark conditions

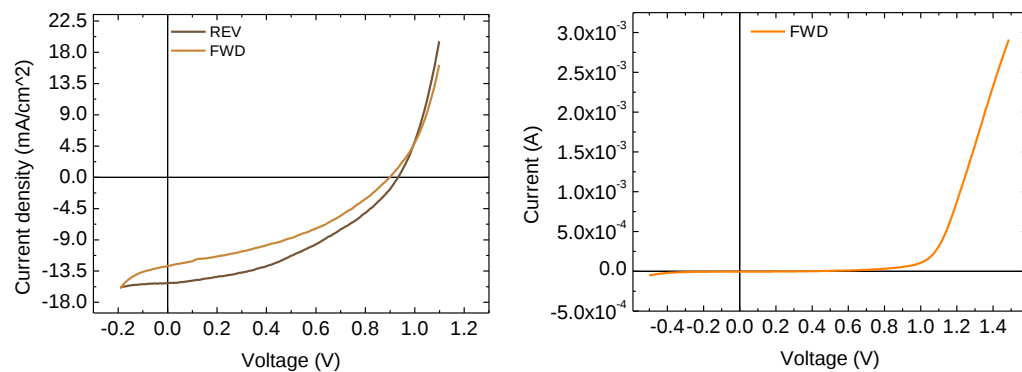


Figure A28.: Sample 16: Left) J-V curve under 1 sun illumination
Right)I-V curve dark conditions

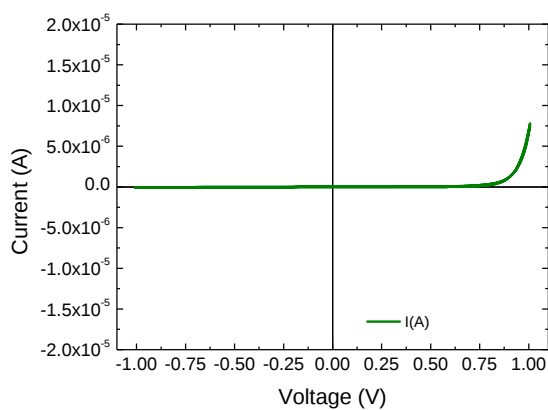


Figure A29.: Cyclic voltammetry of **sample 15** in dark conditions.
(Only cycle 1st, 20th and 40th are represented.)

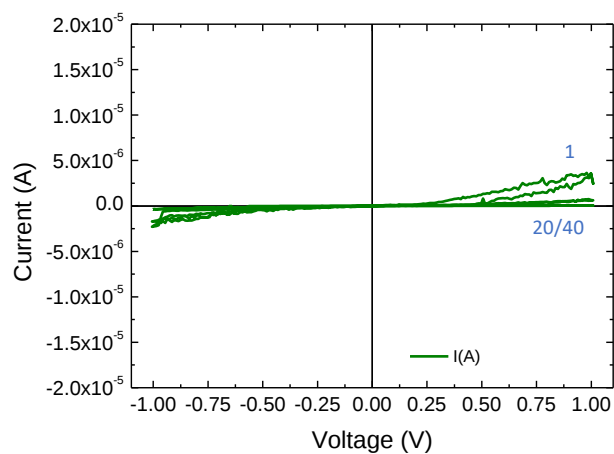


Figure A30.: Cyclic voltammetry of **sample 16** in dark conditions.
(Only cycle 1st, 20th and 40th are represented.)

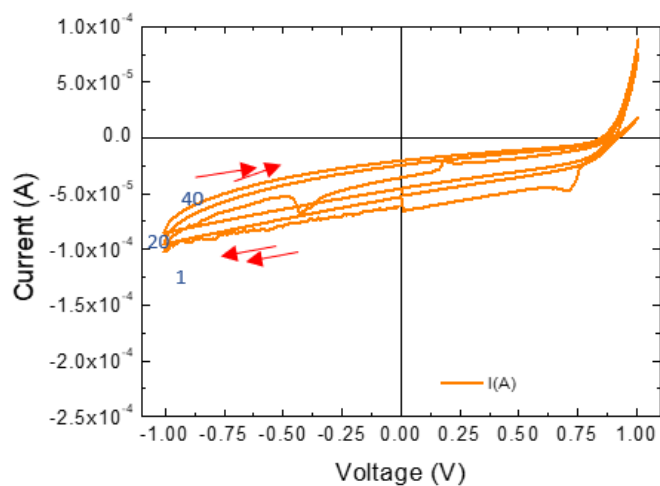


Figure A31.: Cyclic voltammetry of **sample 15** under 1 sun illumination.
(Only cycle 1st, 20th and 40th are represented.)

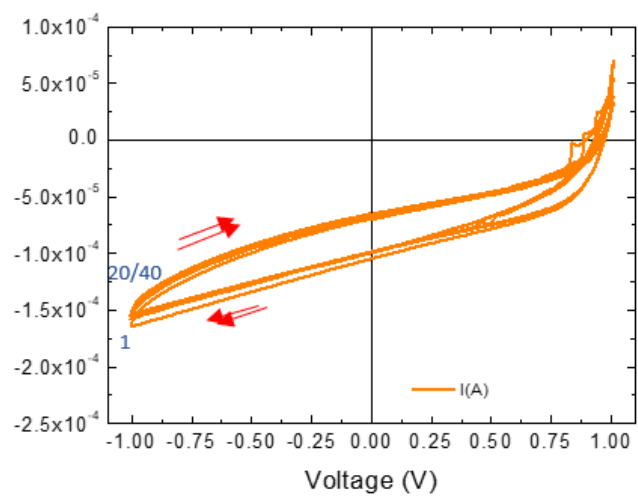
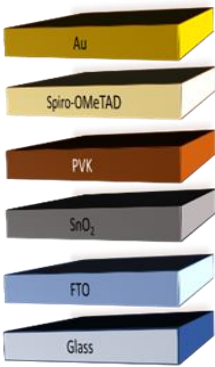
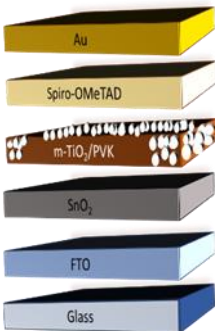
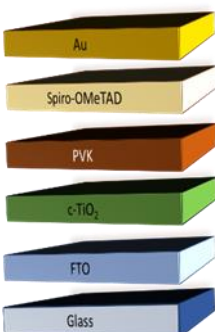
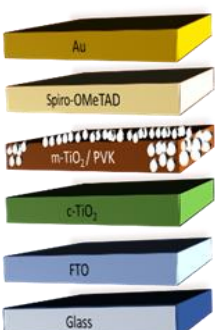


Figure A32.: Cyclic voltammetry of **sample 16** under 1 sun illumination.
(Only cycle 1st, 20th and 40th are represented.)

Table A5: Main average values of all structures studied

Device layout	PCE(%)	HI	ON/OFF RATIO	V _{set} (V)	V _{reset} (V)	Endurance 40 cycles
	6.2 ± 1.8	0.63 ± 0.07	3.13 ± 0.61	-0.26 ± 0.06	-0.70 ± 0.03	NO
	5.3 ± 3.6	0.57 ± 0.13	1.25 ± 0.13	-0.29 ± 0.01	-0.82 ± 0.03	YES
	6.7 ± 1.8	0.40 ± 0.06	1.42 ± 0.12	0.79 ± 0.03	-	YES (Increase with cycles)
	3.6 ± 1.0	0.36 ± 0.16	2.62 ± 0.97	0.72 ± 0.05	-	YES

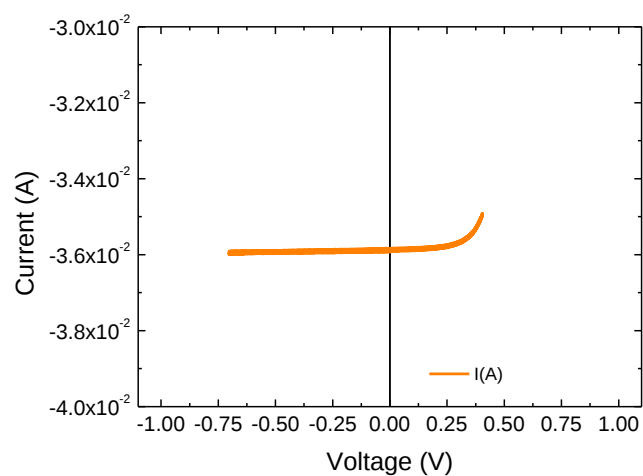


Figure A33.: Cyclic Voltammetry of ‘Silicon PV’ under 1 sun illumination. (Only cycle 1st, 20th and 40th are represented.)

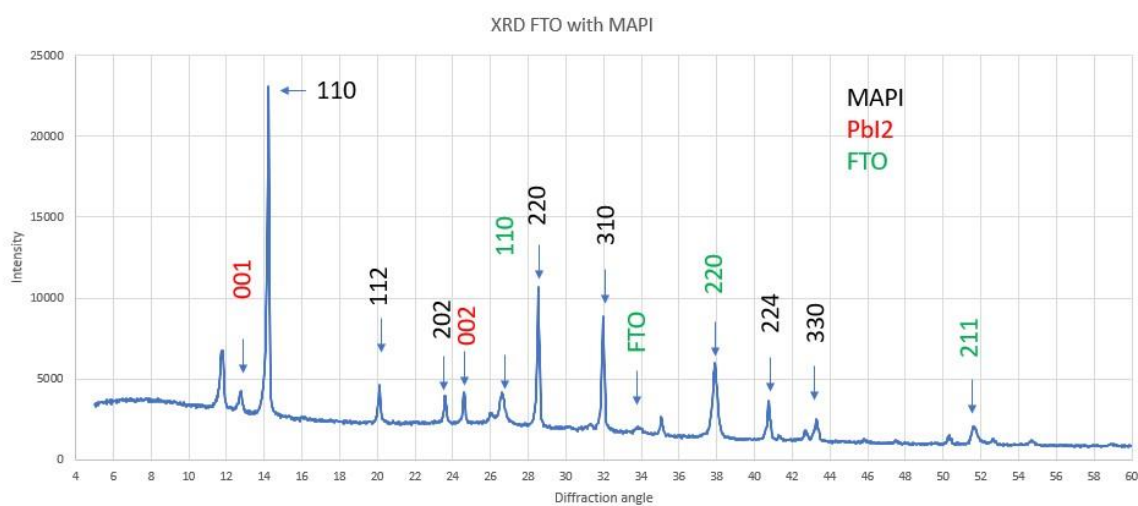


Figure A34.: XRD analysis of FTO-MAPIperovskite.